

**CARB LCFS EWG  
Work Plan  
Indirect Effects of Other Fuels Sub-Working Group (SWG)**

**1) What is the definitive scope of this group?**

- a. The scope of this group is to develop an understanding of the indirect effects of all significant fuels likely to play a role in the LCFS. We will start with the fuels that have direct effects in place, and move to fill the gaps around their associated indirect effects in an attempt to develop appropriate carbon scores for inclusion within the LCFS. While such a broad scope is unlikely to be fully addressed in the 1<sup>st</sup> year, we do think that some consideration should be given to at least identifying the possible indirect effects from other fuel pathways and potential methodologies for determining their appropriate carbon scores for inclusion within the LCFS. This will include the identification of potential indirect effects, existing data sets, data needs, and to identify or point out the needs for potential methodologies and develop them over a longer-term basis.

**2) What are the prioritized goals and milestones for this group over the time period?**

- a. Establish criteria for defining what “indirect effects from other fuels” should consider in principle:
  - i. *Non-land use indirect effects affects should be considered for all fuels.*
  - ii. *It is the consensus of this SWG that the boundary conditions include all indirect effects associated with any potential fuel and not limited to indirect land use change. For example: considerations about battery manufacturing life cycle implications, water use implications from shale NG production, and hydrogen production from merchant H2 production plants are currently not evaluated under the current methodology. Important to identify all potential indirect effects and their impact in terms of carbon scoring.*
  - iii. *At a minimum, a list should be prepared which identifies the current impacts that are excluded from both the GTAP and CARB WTW GREET-based model that should be considered for inclusion, as a function of fuel type, within the LCFS scoring system.*
  - iv. *Identify alternative approaches to commodity-based equilibrium models that may be more appropriate to predict indirect effects; ties to other SWG on other comparative models for the LCFS.*
  - v. *Identify potential changes to the current fossil fuel mix as a function of time to develop a temporal baseline for the LCFS calculations; Identify the marginal fossil fuel(s) in the Californian fuel mix, i.e. the*

*fossil fuels most likely to be affected by an increase in alternative fuels production*

- vi. *Identify co-products of all fuels and potential indirect effects; ties to other SWG on co-products*
- b. Develop an extensive initial list of possible indirect effects to be assessed with regard to non-corn ethanol pathways and other non-biofuel approaches
- c. Identify the largest concerns which may be not accounted for in current WTW indirect effects for all fuels
- d. Identify the available data for estimating these effects, and possible methods for strengthening these estimates, and models capable of processing those training sets
- e. Identify a work program for addressing the highest priority concerns from the first review period and outline a long-term research plan for the items that cannot be addressed in the time available.

**3) Milestones**

<b>Goal</b>	<b>Deadline</b>
Establish indirect effect criteria as a function of fuel type	May 2010
Develop initial listing of indirect effects as a function of fuel type	June 2010
Identify gaps in current models and approaches	July 2010
Identify data to fill current gaps and potential alternative methodologies/modeling approaches	September 2010
Develop a long-term work plan for the ARB and LCFS	October 2010

**4) What additional experts/resources do we need to fulfill this mission on time?**

- a. Tiax (Mike Jackson or Jennifer Pont)
- b. Mark Delucci, UC Davis
- c. Michael Wang, Argonne
- d. Patricia Monihan, Union of Concerned Scientist
- e. John Sheers, CEERT
- f. Dan Kammen, UC Berkeley
- g. Robert Sawyer, UC Berkeley
- h. Alan Lloyd, ICCT
- i. Jim McMahan, LBNL
- j. Dawn Manley, Sandia
- k. Heather Johnson, EBI

- l. Björn Pieprzyk, Energy Research Architecture
- m. Norbert Kortlüke, Energy Research Architecture
- n. Paula Rojas Hilje, Energy Research Architecture

**5) What are the prioritized goals for the CARB EWG long-term on this topic?**

- a. Identify the key indirect effects possible from other fuels to ensure a level playing field
- b. Establish an initial screening methodology for determining if a minimum effects threshold can be defined
- c. Identify and undertake a scope of work through either the EWG or a consultant to provide a 1<sup>st</sup> order quantified estimate of large indirect effects associated with other fuel pathways and recommended interim adjustments to the carbon intensity for such paths.
- d. Identify modeling approaches that can predict the impact of new technologies as they come online for evaluation under the LCFS

**6) Additional Comments**

The first issue is to achieve some consensus that there are other indirect effects besides those mediated by land use. While market mediated effects certainly exist, in the context of the LCFS it is better to focus on energy and other tangible resource considerations, rather than price-driven short and long term effects. The use of price-dependent elasticity is therefore a concern, although it is implicit in the application of the GTAP model. There are huge uncertainties implicit in the GTAP structure which attempts to provide a systematic treatment of many interdependent parts, including the following:

- International trade,
- Domestic consumption and output using CET and CES structures,
- Market clearing conditions and price linkages nested within the standard GTAP Model.<sup>1</sup>

The following are examples of some possible indirect effects that should be considered by this subgroup:

<b>Gasoline/Diesel</b>	H2 accounting: Air Products says H2 = 2% of energy in CA gasoline yet merchant H2 plants are excluded from the GREET model
<b>BEVs + Hybrids</b>	Battery materials production, transport, battery manufacturer + transport, and end-of-life recycling requirements excluded from LCFS
<b>NG</b>	Conventional gas is being systematically replaced with shale gas, tight gas and CBM. Horizontal drilling + high pressure

<sup>1</sup> GTAP paper, Feb., 2010, "Linking Partial and General Equilibrium Models: A GTAP Application Using TASTE" , Badri Narayanan G., Thomas W. Hertel and J. Mark Horridge

	multi-stage fracking of marine shale involve higher energy use ( <i>e.g., production and use of proppant used in injections</i> )
<b>Electricity</b>	Battery production life cycle issues  BP/SCE Pet coke CO2 “sequestration” is being used for EOR; this “co-product” should be “credited” as a debit...
<b>H2</b>	Energy for precooling associated w/ SAE J 2601 5 kg/3 min (60 g/s) adjusted for parity between veh. 1 + 3 refill times.
<b>Crude oil</b>	The LCFS assumes carbon intensity is constant for the base year. What happens to the carbon intensity in the future as the mix of crudes changes in California?
<b>Ethanol and other biofuels</b>	What are the indirect effects not currently captured in ARB’s analysis?
<b>Validation of all pathways</b>	Current models are not based on validated data, but primarily paper studies, peer review literature and other estimates.